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TUNG & ASSOCIATES
Suite 120
838 W. Long Lake Road
Bloomfield Hills, MI 48302

EXAMINER	
KORNAKOV, MICHAIL	
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BEFORE THE BOARD OF PATENT APPEALS

AND INTERFERENCES

Application Number: 09/847,511

Filing Date: May 02, 2001

Appellant(s): WANG ET AL.

Randy W. Tung

For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed November 3,2004 appealing from the Office action mailed May 18, 2004.

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(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

4,417,945	Komatsuzaki	11-1983
5,922,431	Weber et al	11-1999
5,593,505	Erk et al	01-1997
5,033,999	Cardani et al	04-1991
5,998,186	Ward et al	11-1999
4,657,631	Noguchi	04-1987

Handbook of Semiconductor Wafer Cleaning Technology edited by W. Kern. Noyes Publications, 1993, page 24.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 5, 6 stand rejected under 35 U.S.C. 102(b) as being anticipated by Komatsuzaki (U.S. 4,417,945), as per reasons of record.

Komatsuzaki discloses apparatus for any liquid treatment of a wafer (abstract). The apparatus of Komatsuzaki comprises **treatment vat** (reads on tank body) with treatment solution, means for **holding the wafer(s) in vertical position** and **means for reciprocally moving the wafers' holding means with wafer(s) being immersed into the treatment solution**. The wafer holding means are moved **reciprocally** up and down by a mechanism with a cylinder and a piston (see Abstract, col.1, lines 6-12; col. 2, lines 15-37; col.3, lines 46-63; col.4, lines 60-65; col.5, lines 58-62; Fig.4 and 5).

With regard to the limitation of the instant claim 1, that the "...wafer is immersed in a stripper solution at a frequency of not more than 100 cycle/min", it is noted that such limitation is not relevant to the apparatus claims, because what defines the patentability of apparatus, is its structural elements, but in no way the method by which it operates. In other words, apparatus claims must be structurally distinguishable from the prior art in terms of structure not function. In re Danley, 120 USPQ 528, 531 (CCPA 1959); Hewlett-Packard Co. V. Baush and Lomb, Inc., 15 USPQ2nd 1525, 1528 (Fed. Cir. 1990); Furthermore, since the structural limitations of the claimed apparatus are met by the disclosure of Komatsuzaki, the wafer holder of apparatus of Komatsuzaki is fully capable of being operable at a frequency of up to 100 cycle/min.

Therefore all structural elements of apparatus as per instant claims 1, 5 and 6 are met by Komatsuzaki, and are therefore anticipated by this reference.

Claims 1, 2 stand rejected under 35 U.S.C. 102(b) as being anticipated by Weber et al (U.S. 5,922,431), as per reasons of record.

Weber teaches device for treating substrates, such as semiconductor wafers. The device of Weber comprises fluid container (reads on "tank", as instantly claimed) into which liquid chemicals can be introduced (col. 5, lines 29-35), an overflow opening via which the fluid entering the container can flow out (col.8, lines 33-35), wafer receiving device (reads on "wafer holder", as instantly claimed) and means for lifting and lowering or reciprocating vertically the wafer receiving device (col.7, lines 49-53). The liquid media is contained within the fluid container during wafer processing (col.8, lines

17-35). Therefore, the device of Webber is fully capable of holding, immersing and reciprocating at least one wafer being in vertical position. Since the structural limitations of the claimed apparatus are met by the disclosure of Weber, as acknowledged by Appellants in their response as of 02/20/2004, the wafer holder of apparatus of Weber is fully capable of being operable at a frequency of up to 100 cycle/min.

The device of Weber also comprises heating means for heating the fluid contained in said fluid container (col.6, lines 38-41). Therefore, all the limitations of the instant claims 1 and 2 are met by Weber.

Claims 2, 9 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsuzaki in view of Erk et al. (U.S. 5,593,505), as per reasons of record.

With regard to claim 2, Komatsuzaki remains silent about the use of heating means for heating the treatment solution, as per claim 2 . However, the heating of treatment solutions is widely utilized in the art in order to enhance cleaning efficiency.

Erk discloses method of cleaning semiconductor wafers and in order to enhance semiconductor cleaning process Erk utilizes reciprocal motion of wafers, which are placed in the bath. Erk also indicates that raising the bath temperature is beneficial for cleaning procedure (col.3, lines 28-29). Therefore the heating means are inherent in the teaching of Erk.

Because both Komatsuzaki and Erk are concerned with liquid treatment of semiconductor wafers and Erk indicates the benefits of raising the bath temperature, one skilled in the art, motivated by the disclosure of Erk, at time the invention was

made, would have found it obvious to provide the heating means in order to obtain and maintain the desired temperature of treatment solution in the apparatus of Komatsuzaki.

With regard to the method for removing unwanted film layers, as per instant claims 9 and 15, Komatsuzaki discloses a method comprising the steps of providing a tank with a stripper solution, provides a wafer holder that holds a wafer in a vertical position, as instantly claimed, and the wafer holding means is moved reciprocally up and down by a mechanism with piston and cylinder (Abstract, col.1, lines 6-12; col. 2, lines 15-37; col.3, lines 46-63; col.4, lines 60-65; col.5, lines 58-62; Fig.4 and 5). After completion of liquid treatment in the treatment vat, the wafer is dump rinsed in the rinse vat 16 (col.5, lines 8-12).

The teaching of Komatsuzaki differs from the instant claims by not indicating a specific frequency value of up and down motion. In addition to other semiconductor cleaning means and techniques, in order to enhance semiconductor cleaning process Erk also utilizes reciprocal motion of wafers. Erk provides the range of reciprocating rates from 20 cycles/min to 240 cycles/min and states that the reciprocating rate affects the processing time (col.6, lines 28-31). Erk also discloses the preferable reciprocating rate of at least 60 cycles/min as one of his processing parameters.

Because the reciprocal motion of the substrate is an important element in treatment techniques of Komatsuzaki and Erk, and Erk teaches that the reciprocating rate affects the processing time and, therefore, the cleaning results, one skilled in the art at the time the invention was made, motivated by the teaching of Erk would have

found it obvious to utilize the preferable reciprocating rate of Erk while optimizing the value of reciprocal frequency and cleaning the wafer in a timely manner in the teaching of Komatsuzaki with the reasonable expectation of success.

Claims 3 and 4 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Weber et al. (U.S. 5,992,431) in view of Applicants' admittance or separately over Komatsuzaki in view of Applicants admittance, as per reasons set forth in the previous office action on the merits.

In regard to claims 3 and 4, which are concerned with specific design of wafer holders, it is noticed here that the claimed wafer holders are typical holders, commonly and widely used in the art (paragraph, bridging pages 16 and 16 of the instant disclosure). Therefore, one skilled in the art would have found it obvious to utilize the conventional wafer holders in the apparatus of Weber or Komatsuzaki in order to provide economical and technologically compatible equipment for semiconductor wafer(s) treatment.

Claim 7 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Weber in view of Cardani et al. (U.S. 5,003,999), as per reasons of record.

While teaching the use of heating means, the disclosure of Weber is silent about the utilization of **electrical** heating means. However, conventionally controlled electrical resistors as heating means for liquid processing baths are notoriously utilized

in the art of wet processing of semiconductor wafers, as provided by Cardani (paragraph, bridging col.1 and 2).

Therefore, one skilled in the art, motivated by the teaching of Cordani, would have found it obvious to utilize the electrical heating means, as disclosed by Cordani, in order to provide precise and convenient control of temperature of the treatment solution in the teaching of Weber.

Claims 10, 11 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsuzaki (U.S. 4,417,945) in view of Erk et al. (U.S. 5,593,505) and in further view of Ward et al. (U.S. 5,988,186), per reasons set forth in the previous office action on the merits.

The combined teaching of Komatsuzaki and Erk does not specifically provide for the stripper solution that comprises DMSO and TMAH. However it indicates that the disclosed apparatus can be used for **any liquid treatment** of any plate like materials, thus motivating the skilled artisan to explore different treatment solutions in semiconductor processing.

Ward teaches an aqueous composition, comprising DMSO and TMAH (see example in paragraph, bridging col.6 and 7), which is useful for treatment wafer surfaces during the fabrication of integrated circuits (paragraph bridging col.4 and 5; col. 5, lines 3-31). The composition of Ward is non-corrosive, non-flammable and of low toxicity to the environment.

Because both the combined teaching of Komatsuzaki and Erk and Ward are concerned with liquid treatment of semiconductor wafers and Ward provides for the environmentally safe and non-toxic treatment composition, one skilled in the art, motivated by the teaching of Ward, would have found it obvious to utilize the treatment composition of Ward in order to provide non-corrosive and environmentally safe treatment media and treat the wafers in combined teaching of Komatsuzaki and Erk with the reasonable expectation of success.

Claims 12, 13, 16, 17 and 20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over combined teaching of Komatsuzaki and Erk, as discussed above and in view of Noguchi (U.S. 4,657,631), as per reasons of record.

The combined teaching of Komatsuzaki and Erk does not specifically indicates the step of stationary soaking the wafer in treatment solution for a definite amount of time.

Noguchi teaches removal of a solid layer of photosensitive material from the substrate surface by **stationary soaking** the substrate in a liquid, which is capable of dissolving the photosensitive solid layer followed by agitation of the substrate in order to accelerate the removal process.

Because both the combined teaching of Komatsuzaki and Erk and Noguchi are concerned with liquid treatment of substrates and Noguchi emphasizes acceleration of treatment by stationary soaking the substrate in a processing liquid, one skilled in the art motivated by the disclosure of Noguchi would have found it obvious to soak the

substrate in the process of Komatsuzaki and Erk separately from its agitation in order to process the substrate in a timely manner.

In regard to soaking time, it is noted that this parameter is result effective, because the required dissolving or, alternatively, swelling of the removable layer depends on the characteristics of this particular layer, applied solution and on the duration of dissolution or swelling step. However, discovery of optimum value of result effective variable in known process is ordinarily within the skill in the art and would have been obvious, consult ***In re*** Boesch and Slaney 205 USPQ 215 (CCPA 1980).

Claim 14 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsuzaki (U.S. 4,417,945) in view of Erk et al. (U.S. 5,593,505) and in further view of Handbook of Semiconductor Wafer Cleaning Technology (hereinafter referred to as The Book).

The combined teaching of Komatsuzaki and Erk remains silent about spin drying of wafer(s) after processing. However, the drying of wafers after processing is notoriously used and recognized in the art of semiconductor technology as an extremely critical step, and the spin drying is the most widely utilized drying technique, as provided by the Book (page 24, paragraph 3.5).

Therefore, one skilled in the art, motivated by the teaching of the Book, would have found it obvious to spin dry wafer(s) in the teaching of Komatsuzaki and Erk, after their rinsing, in order to prevent re-deposition of unwanted elements onto the wafer's surfaces and provide for the proper storing.

Claim 18 stands rejected under 35 U.S.C. 103(a) as being unpatentable over combined teaching of Komatsuzaki, Erk and Noguchi (U.S. 4,657,631) and in further view of Ward et al. (U.S. 5,988,186).

The combined teaching of Komatsuzaki, Erk and Noguchi applied to independent claim 16 does not specifically provide for the stripper solution that comprises DMSO and TMAH. However it indicates that the disclosed apparatus can be used for **any liquid treatment** of any plate like materials, thus motivating the skilled artisan to explore different treatment solutions in semiconductor processing.

Ward teaches an aqueous composition, comprising DMSO and TMAH (see example in paragraph, bridging col.6 and 7), which is useful for treatment wafer surfaces during the fabrication of integrated circuits (paragraph bridging col.4 and 5; col. 5, lines 3-31). The composition of Ward is non-corrosive, non-flammable and of low toxicity to the environment.

Because both the generic teachings of Komatsuzaki Erk and Ward are concerned with liquid treatment of semiconductor wafers and Ward provides for the environmentally safe and non-toxic treatment composition, one skilled in the art, motivated by the teaching of Ward, would have found it obvious to utilize the treatment composition of Ward in order to provide non-corrosive and environmentally safe treatment media in the treatment of wafers of Komatsuzaki and Erk.

Claim 19 stands rejected under 35 U.S.C. 103(a) as being unpatentable over combined teaching of Komatsuzaki, Erk, and Noguchi, as discussed above and in further view of Handbook of Semiconductor Wafer Cleaning Technology (The Book).

The combined teaching of Komatsuzaki, Erk and Noguchi remains silent about spin drying of wafer(s) after processing. However, the drying of wafers after processing is notoriously used and recognized in the art of semiconductor technology as an extremely critical step, and the spin drying is the most widely utilized drying technique, as provided by the Book (page 24, paragraph 3.5).

Therefore, one skilled in the art, motivated by the Book, would have found it obvious to spin dry wafer(s) in the teaching of Komatsuzaki, Erk and Noguchi, after their rinsing, in order to prevent re-deposition of unwanted elements onto the wafer's surfaces and provide for the proper storing.

(10) Response to Argument

Applicant's arguments in Brief, filed 11/03 /2004, have been fully considered but they are not persuasive.

With regard to Komatsuzaki reference on rejection of claims 1, 5 and 6, Appellants' argument resides in contention that Komatsuzaki does not teach "...means for reciprocally moving the wafer holder at a frequency of up to 100 cycle/min". In response to this it is noted that the structural limitations of the claimed apparatus per se are fully met by the disclosure of Komatsuzaki. The limitations of " reciprocally moving the wafer holder .....at a frequency of up to 100 cycle/min" is directed to the way the

claimed apparatus operates. However, what defines the patentability of apparatus, is its structural elements, but in no way the method by which it operates. In other words, apparatus claims must be structurally distinguishable from the prior art in terms of structure not function. In re Danley, 120 USPQ 528, 531 (CCPA 1959); Hewlett-Packard Co. V. Baush and Lomb, Inc., 15 USPQ2nd 1525, 1528 (Fed. Cir. 1990); Furthermore, since the structural limitations of the claimed apparatus are met by the disclosure of Komatsuzaki, the wafer holder of apparatus of Komatsuzaki is fully capable of being operable at a frequency of up to 100 cycle/min. Appellants further argue that the limitation to sustain the reciprocating frequency up to 100 cycles /min is a structural limitation of the apparatus, and is directed to a structural rigidity or requirement of the apparatus. This is not found persuasive, because when read in light of the instant specification, the claimed means are defined as " The air cylinder assembly 76 or any other suitable means, is used to provide reciprocation" (see specification, page 16, paragraph 0035, wherein "means" are not further defined in the specification). Therefore, as admitted by Appellants in the instant specification, any suitable means including those recited in the applied prior art are capable of sustaining the claimed frequency range. In addition to this, the property of rigidity, on which Appellants rely, is never referred to either expressly or implicitly in the instant claims and/or specification. And last, but not the least, the claimed range "up to 100 cycles/min", includes the frequency of zero, therefore, including the embodiment, wherein the reciprocation is not essential at all.

With regard to Weber's reference on rejection of claims 1 and 2, the crux of Appellants' argument is that Weber does not teach means for reciprocally moving the wafer holder at a frequency of up to 100 cycle/min. However, Appellants admitted that Weber et al. disclose the substrate receiving device, which can be moved reciprocally in the vertical direction to lower and lift the wafers into and out the fluid container. Thus, Appellants themselves acknowledge that the structural limitations of the claimed apparatus are met by Weber. The way the apparatus operates, i.e. functional limitations of apparatus do not impart patentability, since the substantially identical apparatus of Weber is fully capable of operating its wafer holder at the claimed frequency (the pertinent case law is discussed above). In addition to this, the property of rigidity, on which Appellants rely, is never referred to either expressly or implicitly in the instant claims and/or specification. And last, but not the least, the claimed range "up to 100 cycles/min", includes the frequency of zero, therefore, including the embodiment, wherein the reciprocation is not essential at all.

With regard to 35 USC 103(a) rejection of claims 2, 9, and 15 over Komatsuzaki in view of Erk. Appellants argue that there is no motivation to combine references to Komatsuzaki and Erk because Komatsuzaki, while teaching the up and down motion, does not teach frequency. Erk teaches the cleaning by passing wafers through gas-liquid interface, and as acknowledged by Appellants, Erk also teaches ***reciprocal up and down movement, which is most effective near the gas liquid interface*** (emphasis added - M.K.), and since Erk, in Appellants' opinion, teaches half

of the wafer immersed, and Komatsuzaki teaches the whole wafer immersed, therefore, there is no motivation to combine these two references.

In response to Appellants' argument, the Examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In the instant case, both Erk and Komatsuzaki teach wet chemical treatment of semiconductor substrates and **both teachings comprise the same process enhancement technique**, namely the **reciprocal motion of the substrate positioned in the processing liquid**. Erk states that the reciprocating rate affects semiconductor processing time and that sufficient reciprocating rate leads to accelerated cleaning, therefore exposure to other treatment tools (techniques) can be minimized (col.6, lines 28-37). Erk also discloses the preferable reciprocating rate of ***at least 60 cycles/min*** (reads on up to a 100 cycles/min) as one of his processing parameters. Therefore, one skilled in the art at the time the invention was made, motivated by the teaching of Erk would have found obvious to utilize the preferable reciprocating rate of Erk in order to ***accelerate treatment*** of semiconductor substrate in the teaching of Komatsuzaki with the reasonable expectation of success.

It is also noted that had Erk taught the exact same process as Komatsuzaki (in terms of substrate immersion) with the claimed frequency of motion, the Erk reference would have been used alone as a 102 reference.

In response to the argument that Erk does not teach a method in which a wafer is **completely** immersed in a stripper solution, Appellants are advised that the feature upon which Appellants rely (i.e., **completely** immersing) is not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Appellants' argument with regard to rejection of claims 3 and 4 over Weber in view of admitted prior art or separately over Komatsuzaki in view of admitted prior art, resides in contention that neither Weber, nor Komatsuzaki teach the limitation of 100 cycles /min for the functional limitation of the claimed apparatus. This issue was fully addressed above in the sections of 35 USC 102 rejections of apparatus claims over Weber and Komatsuzaki, each one individually, and the above rationale is incorporated herein in its entirety. Appellants' admission in the rejection of claims 3 and 4 has been used to remedy the deficiency of a specific design of wafer holders not taught by the primary references. The claimed wafer holders are typical holders, commonly and widely used in the art, as admitted by Appellants in the instant specification (paragraph, bridging pages 16 and 16 of the instant disclosure).

Appellants' argument with regard to rejection of claim 7 over Weber in view of Cardani is not persuasive, because this argument is once again based on alleged patentability of the functional limitation of the apparatus i.e. the ability of the wafer holder to move at the frequency of up to 100 cycles/min. It is once again reiterated that significance of the functional limitation in otherwise identical apparatus has been addressed above and is incorporated herein. And last, but not the least, the claimed range "up to 100 cycles/min", includes the frequency of zero, therefore, including the embodiment, wherein the reciprocation is not essential at all.

The crux of Appellants' argument, with regard to rejection of claims 10 and 11 over Komatsuzaki in view of Erk, and in further view of Ward, appears to hinge on alleged incompatibility of Komatsuzaki and Erk. According to Appellants, these two references involve completely different art area of cleaning. The degree the wafer is exposed to a cleaning solution and the agitation of the cleaning solution are allegedly different in the applied references. Additional reference of Ward according to Appellants, while discloses the chemical compositions, does not lend any additional weight in a 103(a) rejection based on the two main references of Komatsuzaki and Erk.

This is not found persuasive for at least the following reasons:

- Komatsuzaki discloses all method steps, identical to those in the ***independent*** claim 9. Komatsuzaki only differs from the instant dependent claims 10 and 11 by not indicating a specific frequency value of up and down motion. In addition to other

semiconductor cleaning techniques, Erk **also utilizes** reciprocal motion of wafers in order to ***enhance semiconductor cleaning*** process. Erk provides the range of reciprocating rates from 20 cycles/min to 240 cycles/min and states that the reciprocating rate affects the processing time (col.6, lines 28-31). Erk also discloses the preferable reciprocating rate of at least 60 cycles/min as one of his processing parameters. The motivation to combine Komatsuzaki and Erk is that one skilled in the art at the time the invention was made, motivated by the teaching of Erk would have found obvious to utilize the preferable reciprocating rate of Erk in order to ***accelerate treatment*** of semiconductor substrate in the teaching of Komatsuzaki with the reasonable expectation of success.

- Appellants have not argued the Ward reference in the rejection of claims 10 and 11.

Appellants' arguments with regard to rejections of claims ***12,13, 16, 17 and 20 over the combined teachings of Komatsuzaki, Erk et al. and further in view of Noguchi*** reside in contention that since the basic cleaning process disclosed in independent method claims 9 and 16 is not rendered obvious by Komatsuzaki and Erk, the Appellants argue that Noguchi does not teach a method step of reciprocally moving wafers up and down at a frequency of up to 100 cycle/min, and therefore, "does not lend any additional weight in a 103(a) rejection".

This is absolutely not persuasive, because the reference to Erk ***does teach*** the reciprocally moving wafers up and down at a frequency of up to 100 cycle/min, and this reference was used to remedy the deficiency of Komatsuzaki for **METHOD** claims. The reference to Noguchi is in no way applied to address the frequency, but to show how the step of soaking the wafer in a liquid taught by Noguchi can be introduced into the combined process of Komatsuzaki and Erk.

The crux of Appellants' arguments with regard to rejections of claims ***14, 18 and 19 as being unpatentable over Komatsuzaki in view of Erk, and further in view of "Handbook of Semiconductor Wafer Cleaning Technology",*** appears to hinge on the limitation of reciprocal movement of the wafer holder with the frequency of up to 100 cycles/min that allegedly is not met by the combination of Komatsuzaki and Erk. This issue has been addressed numerous times in the present communication, and is incorporated herein in its entirety.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Mikhail Kornakov
Primary Examiner
Art Unit 1746

M. KORNAKOV
01/21/2005

Conferees:

Dr. R. King

M. Barr

APPEAL CONFEREE:

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

MICHAEL BARR
SUPERVISORY PATENT EXAMINER